

# (12) UK Patent Application (19) GB (11) 2 087 959 A

(21) Application No 8112566  
(22) Date of filing 23 Apr 1981  
(30) Priority data  
(31) 210542  
(32) 26 Nov 1980  
(33) United States of America (US)  
(43) Application published 3 Jun 1982  
(51) INT CL<sup>3</sup>  
A63C 19/04  
(52) Domestic classification  
E1G 60A2 60N 60P 60U 62  
A6D 39X  
(56) Documents cited  
GB 2046599A  
≡ WO 80/00649  
GB 1528264  
US 3995079A  
(58) Field of search  
A6D  
E1G  
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## (54) Tennis court surface

(57) A stabilised sand surface for tennis courts is formed of a thick, densely tufted, coarse, synthetic fibre carpet 20 which is covered with a single layer 32 of fine, dry, silica sand. The carpet tufts 24 each comprise numerous, closely packed, resilient, somewhat twisted strands of

substantially equal length, which are tufted to a resilient carpet base sheet 21 so that the strands tend to intertwine, but extend generally upright from the sheet. The sand layer 32 covers the carpet and fills the interstices from the base sheet to substantially the full height or a little below the full height of the strands. The sand covering layer is stabilised by the mat-like network formed of the closely packed, intertwined, resilient strands against substantial permanent shifting or wind loss, while being relatively yieldable under impact of the tennis ball to produce a playing surface which simulates the playing quality of a clay-type tennis court surface.

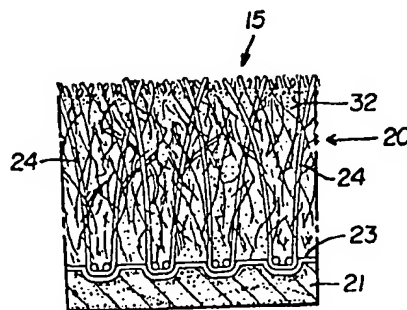
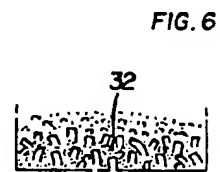
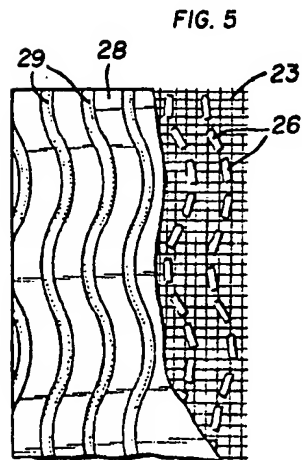
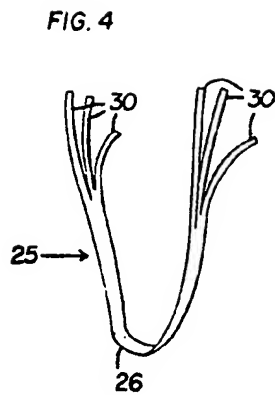
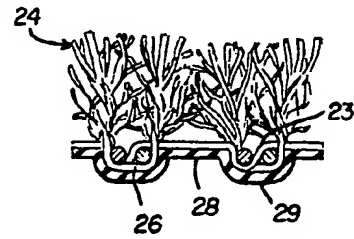
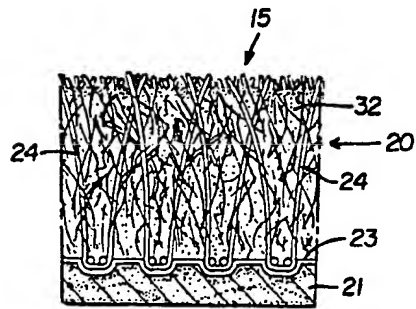
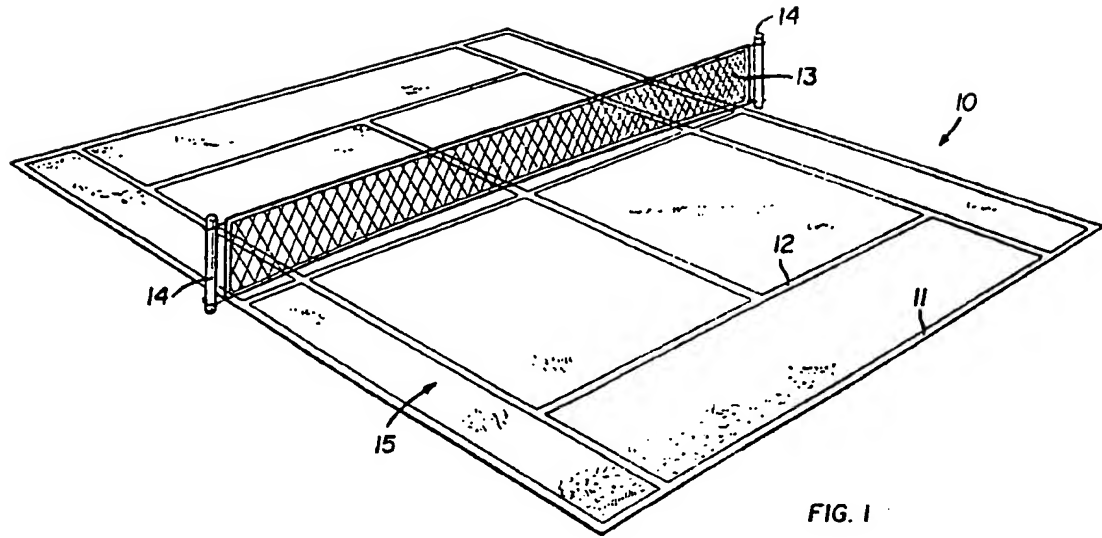


FIG. 2

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## SPECIFICATION

## Tennis court surface

This invention relates to playing surfaces for tennis courts. Tennis court surfaces are commonly  
 5 made of a compacted layer of clay material, or of asphalt, or concrete or the like. Grass or turf surfaces also have been used, but because of the expense and the degree of care required, grass courts have mostly disappeared from use,  
 10 although still used for certain tennis matches.

Another type of tennis court surface is formed of a synthetic carpet covered with granular material. An example of such a surface is described in US Patent No. 4,044,179. In this type  
 15 of court, a flat under-surface or support surface is formed on the ground, usually with suitable drain provisions. Then, this under surface is covered with a so-called "outdoor" synthetic fibre or pile carpet. This, in turn, is covered with layers of  
 20 granular material which provide, along with the tips of the carpet strands where same are exposed, a playing surface.

In this type of carpet, the strands or fibres or piles are fastened, either by tufting or by direct  
 25 fastening, to a base or backing sheet which may be formed of a woven material with or without a rubber-like backing layer secured to the woven material.

In the synthetic carpet type of playing surface,  
 30 as described in the above patent, the carpet has been covered by multiple layers of granular material. That is, a fine sand layer is laid directly upon the base sheet, around the strands. A coarse sand layer is applied over the fine sand layer. In  
 35 addition, a moisture retention material, such as vermiculite or the like, is included either as a separate layer or mixed with the sand, in order to retain a pre-determined amount of moisture to hold the sand against shifting. However, the use of  
 40 multiple layers, particularly of different grain sizes, and the additional moisture retention materials, increases expense because of increased difficulty in applying and maintaining the surface for long  
 45 periods of time, particularly where the court is exposed to extreme changes in weather conditions as is common in many parts of the world where tennis is played.

The present invention is concerned with improving the above mentioned type of tennis  
 50 court surface. More specifically, this invention is concerned with providing a stabilised sand-type of playing surface which is somewhat resilient to provide the ball rebound and speed characteristics that are generally found in clay-type courts, but  
 55 wherein the application of the sand surface is simplified and the sand is stabilised against permanent shifting or wind blowing.

From one aspect, the invention provides a stabilised sand surface for a tennis court formed of  
 60 a synthetic pile carpet laid upon a flat support surface, and covered with a granular material, comprising: a pile carpet formed of relatively thick, substantially equal length strands of a synthetic fibre of between one-half to two inches

65 (1.27—5.08 cms) in length, with each of said strands being fastened at its lower end to a relatively resilient, generally flat carpet base sheet, and extending upright therefrom, and with the strands being densely packed together, with  
 70 adjacent strands generally tending to partially intertwine together to form a thick, dense, mat-like network; and a coating of substantially dry, fine, silica sand, such as in the range of about 40—50 mesh size, covering the carpet base sheet  
 75 and the strands to a uniform thickness, the coating being of a pre-selected height of between the free ends of the strands to a short distance beneath said free ends for exposing a pre-determined length portion of the tips of said free ends; and  
 80 said sand coating filling the interstices between the closely adjacent strands, whereby the mat-like network resiliently stabilises the sand coating against permanently shifting under ball impact and wind blowing.

85 From another aspect, the invention provides a method for forming a stabilised sand tennis court surface which simulates a clay-type playing surface, comprising: applying a synthetic pile carpet of tennis court size and shape upon a flat  
 90 support surface, with said pile carpet being formed of densely packed upright extending, resilient strands, each having its lower end secured to a base sheet and a free upper end, with the adjacent strands tending to partially intertwine to form a  
 95 mat-like network which is relatively thick; covering the carpet and filling the interstices in the network with a single layer of substantially dry, fine, silica sand, such as in the approximate range of 40—50 mesh, to a uniformly pre-determined depth which  
 100 is between the full height of the strands to a short distance below the strand height, so that the strand particles are resiliently held in position by the network, against permanent shifting due to ball impact and against wind blowing.

105 The invention thus comprises a stabilised sand layer tennis court surface formed of a layer of relatively fine, dry, silica sand, resiliently stabilised by a dense, thick, mat-like network of intertwined strands formed by a densely tufted, coarse fibre,  
 110 synthetic plastics material carpet. The carpet is formed of a resilient sheet base, such as rubber coated woven fabric to which is fastened, such as by tufting, synthetic plastics piles or fibres. The fibres are coarse, relatively slippery and tend to  
 115 partially intertwine so as to form a dense network whose interstices are filled with the sand.

The dry, fine, sand filled network formed of the resilient fibres, provides a playing surface which closely simulates a clay court type of surface.  
 120 However, although the improved surface tends to yield resiliently under ball impact, player foot pressure and the like, it is stabilised against permanent shifting of the sand and also against dispersal of the sand by wind blowing conditions.  
 125 Thus, the surface is easy to apply and to maintain over long periods of time, substantially reducing the need for redistributing or smoothing or otherwise caring for the surface, such as is required for the typical clay-type court. Because

the mat-like tangled network of fibres is thick and dense, there is a co-action between the network and the sand which stabilises the complete surface and provides the desired resiliency and surface playing conditions. The ball rebound speed can be adjusted by exposing more or less of the tip portions of the fibres so that these can fold down and momentarily form a slippery surface, under ball sliding impact. This regulates the speed of sliding of the ball upon the surface. Alternatively, the filling can completely cover the network so that, for all practical purposes, only the sand appears for impacting by the ball.

According to a further feature of the invention there is used a plastics fibre material such as stretch oriented polypropylene extruded strands which are thin, flat, narrow strips and which tend to shred longitudinally in use so that each strand tends to form a plurality of finer strands for better intertangling with each other and the sand.

One object of this invention is to provide an easy to apply court surface which requires minimal maintenance or expensive up-keep and which provides clay-like surface playing characteristics. In keeping with this, the carpet may be formed of strands of appropriate colours to provide the necessary boundary lines and other markings which appear on a tennis court. Because the tips of the strands may be slightly exposed through the sand, the colours of the tightly packed fibres appear to the eye of the user and thus present permanent markings or colour upon the court. Consequently, the normal need to mark or replace court lines is eliminated.

Other parts of the invention are embodied in the preferred form which will now be described in some detail by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a conventional tennis court;

Figure 2 is an enlarged, fragmentary view, of the composite carpet and sand surface material upon the supporting ground surface;

Figure 3 is an enlarged, fragmentary view, showing the lower portion of the carpet and the attachment of the tufts thereto;

Figure 4 is an enlarged, perspective view of a U-shaped, bent carpet fibre with split ends;

Figure 5 is a bottom, plan view of the carpet, partially fragmented; and

Figure 6 is an enlarged, fragmentary view of the upper portion of the surface forming carpet and sand layer.

As shown in Figure 1 a conventional tennis court 10 has boundary lines 11 and marker lines 12 to delineate the playing area. Further, a net 13 is stretched between a pair of net posts 14 at the middle of the court. The present invention herein relates to the playing surface 15 which forms the court.

The playing surface is formed of a carpet 20 which is rested upon a support base or sub-surface 21. The base normally comprises an appropriately prepared flat, generally unyielding or firm dirt or like base. That is, the ground is

normally flattened, graded for levelness and draining, and prepared with the appropriate drain means to handle rain and the like. The preparation of the base of the court forms no part of this invention and thus, is shown schematically as the ground 21 in Figure 2.

Upon the ground or base 21, the carpet 20 is laid so that it is flat and ordinarily, tilted or angled a slight amount to the horizontal to provide good drainage therefrom.

The carpet 20 is made of a woven, cloth, backing sheet 23, such as of plastics, woven fibres of polypropylene, nylon or the like. The specific kind of cloth is of no concern here, so long as it is of a material which performs the function described and will stand up to the ambient weather conditions.

Secured to the woven cloth backing sheet 23 are numerous tufts 24 which are densely packed together, i.e. closely secured relative to each other, to the backing sheet. These tufts are formed of numerous individual strands of fibres 25 which are of a synthetic plastics material, as for example, commercially available, stretch oriented, isotactic polypropylene or the like.

The strands or fibres are double bent into a U-shaped configuration to provide a bight 26. A large number of strands are held together into the tuft shape, as for example, a dozen fibres, which are double bent to thereby provide two dozen strands or piles. Each of the U-shaped halves or legs or piles may be of the order of about one-half inch to two inches (1.27—5.08 cms) in length and preferably, approximately one inch (2.54 cms) in length for good results.

The fibre tufts may vary in exact size and thickness, for example, in the range of about 5700 to 7600 denier. Preferably, each fibre is considerably wider than it is thick, such as 1 1/2 to 2 mils (0.0375—0.05 mm) thick and about 1/16 inch (1.59 mm) in width to form a paper thin, narrow strip. These strips are resilient to a considerable degree because of the nature of synthetic plastics, and particularly of the kind mentioned above. Moreover, the fibres tend to tangle and partially intertwine with each other to form a tangled, dense network or mass.

The tufts themselves are closely arranged upon the backing sheet and may be threaded through the backing sheet so that the tuft bights 26 are held in the backing sheet. Placing the tufts closely together, such as roughly 1/8 inch (3.18 mm) apart in one direction and roughly 1/4 inch (6.35 mm) apart in the opposite direction, tightly packs them together to form the dense network or mass required here. The carpet formed with these tufts is roughly between about 24—36 oz. per square yard (815—1220 gm/m<sup>2</sup>) in weight.

The bottom surface of the woven backing sheet is preferably covered with the thin coating of monolithic, rubber-like material which provides a rubberised protective undersurface to rest upon the ground. Because the rubber-like coating is relatively thin, i.e. of the order of less than 1/32 inch (0.79 mm), for example, welts or beads are

formed around the bight portions of the tufts which extend beneath the woven backing sheet. These tread welts or beads tend to align into rows to form tread-like formations 29 or separate downwardly extending bumps or protrusions. These downwardly extending enlargements function to grip into the ground surface to hold the carpet better against transversely slipping thereon.

The individual fibres or strands, as illustrated in Figure 4, are paper-like in thickness, but are relatively wide, such as, for example, of the order of 1/16 inch (1.59 mm). If formed of a stretch oriented polypropylene, or the like, the fibres have a tendency to split at their ends and to partially sever to form a plurality of relatively curled or tangled end portions on each fibre. This increases the intertwining and resilient curliness of the fibres.

Once the carpet is laid upon the support, a coating layer of silica sand is applied thereon. The sand is of a fine grain, such as between about 40—50 US mesh in grain size. The sand, which is substantially dry, is evenly deposited upon the carpet and smoothed out to the approximate depth equivalent to the height of the strands. That is, the sand covering or layer may be as deep as the height of the carpet or slightly less to expose tip portions of the strands.

The sand covering 32 fills the interstices within the tangled network of fibres or strands. The composite tangled fibre mass and sand particles together form a somewhat resilient, thick surface layer, or sufficient resiliency to handle the usual ball impact and player foot impact which is applied to tennis court surfaces. Because of the fibre network caused resiliency, the layer tends to give and return to its normal original shape. That is, the sand is stabilised against permanently shifting. It is also stabilised against blowing away under heavy wind conditions during dry weather.

When the sand covering layer is at the upper plane of the carpet, the ball strikes the sand and bounds off it or slides upon it, in the same general manner as the ball reacts to a clay-type court. However, the court can be made "faster" by reducing the height of the sand somewhat, so that a small portion of the tips of the strands remains exposed. Thus, when the ball strikes and slides upon the surface, the strand tips contacting the ball tend to bend down and get between the ball and the sand, to thereby provide a slippery surface portion which momentarily permits the ball to slide faster. Once the ball departs from that point, the tip portions of the strands tend to straighten out or return to their normal position. Slight variances in the amount of tip exposure can provide either a faster or slower court for the ball.

In order to reduce the maintenance required, the lines 11 and 12 can be formed of fibres and tufts which are of a different colour than the remainder of the carpet tufts. Thus, the lines are permanently formed within the carpet and no line maintenance is required.

Similarly, maintenance of the sand covering is substantially reduced since the sand layer

thickness tends to remain constant for long periods of the time due to the stabilisation by the tangled network produced by the composite of the carpet fibres and the sand. To the extent that replenishment of sand may become necessary, it is relatively simple to apply and rake a pile of sand of a single general mesh size, over the surface portions where it is required. Thus, the prior usage of multiple layers of different kinds of sands or other granular materials including moisture retention materials, is eliminated by the composite carpet network and fine grain sand used in this invention.

Moreover, the use of a single layer of roughly equal size sand particles reduces the compacting which occurs when smaller particles are mixed with a layer of larger particles. Thus draining is improved with single size particles.

#### CLAIMS

1. A stabilised sand surface for a tennis court formed of a synthetic pile carpet laid upon a flat support surface, and covered with a granular material, comprising: a pile carpet formed of relatively thick, substantially equal length strands of a synthetic fibre of between one-half to two inches (1.27 to 5.08 cms) in length, with each of said strands being fastened at its lower end to a relatively resilient, generally flat carpet base sheet, and extending upright therefrom, and with the strands being densely packed together, with adjacent strands generally tending to partially intertwine together to form a thick, dense, mat-like network; and a coating of substantially dry, fine, silica sand, such as in the range of about 40—50 mesh size, covering the carpet base sheet and the strands to a uniform thickness the coating being of a pre-selected height of between the free ends of the strands to a short distance beneath said free ends for exposing a pre-determined length portion of the tips of said free ends; and said sand coating filling the interstices between the closely adjacent strands, whereby the mat-like network resiliently stabilises the sand coating against permanently shifting under ball impact and wind blowing.

2. A tennis court surface as claimed in claim 1, in which said strands are formed of relatively thick, e.g. roughly 1 1/2 to 2 mils (0.0375 to 0.05 mm) thick narrow strips of polypropylene, to form a carpet of between 24—36 oz. weight per square yard (815—1220 grm/m<sup>2</sup>) of carpet

3. A tennis court surface as claimed in either of the preceding claims, in which said strands are each formed of narrow, flat, thin, strip-like fibres of substantially uniform cross-section, having a width which is many times greater than the fibre thickness, the fibre having a tendency to shred longitudinally to form plural end portions on the fibres.

4. A tennis court surface as claimed in any of the preceding claims, in which said strands are formed of U-shaped, double bent, lengths of fibres which are clustered together into tufts, each comprising a substantial number of fibres per tuft,

which are secured through the base sheet and the lower surface of said base sheet includes a coating of a rubber-like material for providing a resilient base surface.

- 5 5. A tennis court surface as claimed in claim 4, in which the bights of the U-shaped, bent fibres are relatively thinly covered with the rubber-like base sheet coating to provide downwardly protruding tread-like formations on the lower  
10 surface of the carpet to thereby resist sliding movement of the carpet upon the support surface.

6. A method for forming a stabilised sand tennis court surface which simulates a clay-type playing surface, comprising: applying a synthetic  
15 pile carpet of tennis court size and shape upon a flat support surface, with said pile carpet being formed of densely packed upright extending, resilient strands, each having its lower end secured to a base sheet and a free upper end, with  
20 the adjacent strands tending to partially intertwine to form a mat-like network which is relatively thick; covering the carpet and filling the interstices in the network with a single layer of substantially dry, fine, silica sand, such as in the approximate

- 25 range of 40—50 mesh, to a uniformly predetermined depth which is between the full height of the strands to a short distance below the strand height, so that the strand particles are resiliently held in position by the network, against  
30 permanent shifting due to ball impact and against wind blowing.

7. A method as claimed in claim 6, comprising arranging the upper surface of the sand layer beneath the plane of the carpet upper surface  
35 formed by the free ends of the strands, to expose a predetermined length of the tips of the free ends of the strands so that they may bend down against the sand layer surface under ball impact to provide momentarily a relatively slippery contact surface  
40 between the ball and sand layer for effecting the speed of the ball rebound from the tennis court surface.

8. A tennis court surface substantially as described with reference to Figures 2 to 6 of the  
45 accompanying drawings.

9. A method for forming a tennis court surface substantially as described with reference to Figures 2 to 6 of the accompanying drawings.